

INSIDE

2

From Andrew's desk

3

From Jim's desk

6

Electrons are in charge
of plutonium's extreme
volume changes

7

MPA-11 partnering with
industry to improve
biorefinery reliability

8

Simple 'bottom-up'
method enables 3D
super-nanocomposites

9

HeadsUP!

Celebrating service



Recognizing achievement

Azad distinguished for contributions to optics and photonics communities

Abul Azad (Center for Integrated Nanotechnologies, MPA-CINT) has been named a fellow of The Optical Society for his original and pioneering contributions to the research and development of terahertz metamaterials, few-layer metasurfaces, active metamaterials, and terahertz plasmonics in subwavelength hole-arrays. The award, granted by the society's board of directors, recognizes members who have served the organization and the optics and photonics communities with distinction.

As a staff scientist on CINT's LUMOS (Laboratory for Ultrafast Materials and Optical Science) team, Azad seeks to understand and engineer quasi two-dimensional metamaterials. These new classes of artificial materials, consisting of subwavelength-resonating structures, are designed to have electromagnetic properties not found in nature, making them promising for applications in realizing photonic devices with enhanced functionalities.

Azad's research has appeared in journals such as *Science*, *Nature Photonics*, *Nature Communications*, *Physical Review Letters*, *Physical Review B*, *Applied Physics Letters*, and *Optics Letters*. He is the recipient of several Laboratory Outstanding Achievement Awards, has served on national and international conference organizing committees, and contributed his expertise to evaluating National Science Foundation and DOE Basic Energy Sciences proposals.

Azad, who earned his PhD in electrical and computer engineering from Oklahoma State University, was a postdoctoral researcher at Rensselaer Polytechnic Institute and an R&D scientist at Zomega Terahertz Corporation before joining the Lab. His work contributes to CINT's nanophotonics and optical nanomaterials science thrust and supports the Laboratory's Energy Security mission and Materials for the Future science pillar.

Technical contact: Abul Azad

Marchi represents Los Alamos at NAE engineering symposium

Alexandria Marchi (Materials Synthesis and Integrated Devices, MPA-11) recently participated in the National Academy of Engineering's 2019 US Frontier of Engineering Symposium. As an invited contributor, she joined 100 early-career engineers from industry, universities, and government labs in an intensive cross-disciplinary exchange of ideas aimed at sustaining and expanding the nation's innovative capacity. The event was held in North Charleston, South Carolina.



continued on page 4



“

So, 2019 has seen several management changes in MPA, but it has also seen several of our key leaders agree to fill these voids by assuming acting management roles. I think this is a positive development and indicates that MPA is growing leaders who are capable and care enough about our organization to take on added responsibilities when needed.

”

Andrew

From Andrew's desk...

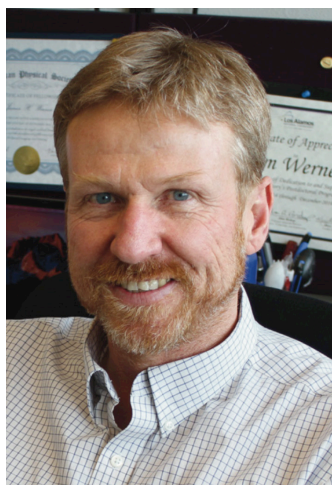
As calendar year 2019 comes to a conclusion, I am thinking about the number of changes that have occurred (and are occurring) in MPA Division. In particular, we have seen some significant changes in MPA division and group management with more changes to come in 2020. We have seen the departure of Rick Martineau (MPA deputy division leader), Andreas Roelofs (MPA-CINT group leader), and Mike Hundley (MPA-CMMS group leader). While both Rick and Andreas have left LANL, many of you know and still interact with Mike in his new role as head of the LANL Office of Science program office, which is an important program space for MPA. CMMS underwent some significant structural changes after Mike left by combining with half of the Applied Modern Physics, P-21, group. The new group, named MPA-Quantum (MPA-Q), has been led by Larry Schultz for the last few months, but Larry is retiring at the beginning of 2020. A search committee to select the next MPA-Q group leader has been formed and is in the process of recruiting a qualified pool of candidates. In the meantime, we are fortunate to have had MPA senior scientists/managers, Tom Venhaus and Eric Bauer, agree to lead MPA-Q for the next few months. These two staff are not the only senior leaders in MPA who have stepped into acting management roles across the organization. For example, Ross McDonald agreed to come over from the magnet lab to help lead CINT as the acting group leader/co-director. The search to find a new CINT group leader/co-director is well under way with several candidate interviews already completed.

In 2019, one of the important management changes for me involved my departure from MPA-11 group leadership after I was selected to become the next MPA deputy division leader. We are again fortunate that senior leaders in MPA-11, including George Goff and Rod Borup, agreed to be acting group leaders while the search for the new permanent MPA-11 group leader occurs. However, before I could unpack the boxes in my new office, I was asked to become the acting MPA division leader when Tanja Pietrass agreed to lead Physics Division on an interim basis. The plan is still for Tanja to return to lead MPA as soon as a new Physics division leader is selected, which should be sometime in the spring of 2020. Further, while it took a few weeks, we now have two people to help manage MPA as acting deputy division leaders for the next few months, including one of our MPA senior scientists and past CMMS deputy group leader, Leonardo Civalé, as well as an experienced manager from Physics Division, David Oro.

So, 2019 has seen several management changes in MPA, but it has also seen several of our key leaders agree to fill these voids by assuming acting management roles. I think this is a positive development and indicates that MPA is growing leaders who are capable and care enough about our organization to take on added responsibilities when needed. This behavior is something I am very thankful for in 2019.

In closing, as one decade comes to an end and a new begins in 2020, I wish you all a productive, happy, and healthy new year.

Acting MPA Division Leader Andrew Dattelbaum



From Jim's desk . . .

“

I thank all participants, speakers, and organizers that helped make this year's meeting a success and I look forward to seeing you all next year.

”

Jim

Another fall has passed us by and we all know what that means—insane crowds on the Aspen Vista trail and at the 2019 Annual CINT Meeting, which was held at La Fonda in Santa Fe September 22-24. I do believe a true highlight of the meeting (as it is every year) was the poster session held on the rooftop of the La Fonda. The view from this place is spectacular! The view is almost as spectacular as the science on display in the poster session.

This year's meeting had three great and timely symposia topics: 1) computation and theory of soft matter; 2) machine learning and nanoscale materials; and 3) 2D materials. Keynote speakers included Prof. Chad Mirkin from Northwestern, Prof. Timothy Lodge from U. of Minnesota, Prof. Tony Heinz from Stanford, and Prof. Rajiv Kalia from U. of Southern California.

An informal workshop on artificial intelligence and machine learning (AI/ML) took place following the annual meeting. This workshop included participation from all five nanoscale science research centers (NSRCs). There were four parallel sessions: 1) physics-based learning for AI/ML; 2) autonomous control and edge computing; 3) big-data/imaging, and 4) in situ multimodal analysis. For each area, sessions focused on who the user community was and the role the NSRCs could play in servicing this community.

I thank all participants, speakers, and organizers that helped make this year's meeting a success and I look forward to seeing you all next year. In closing, I hope everyone reading this has a relaxing and safe holiday season.

MPA-CINT Deputy Group Leader Jim Werner

Recognizing achievement cont.

A member of MPA-11's Weapons Science and Actinide Separation's team, Marchi supports a variety of programs using additive manufacturing (AM), focusing mainly on stereolithography. Using AM techniques, she engineers millifluidic devices to solve actinide aqueous processing and medical isotope purification problems. She is part of a team (mainly in HE Science and Technology, M-7) developing methods to additively manufacture high explosives. An integral member of the Lab's AM community, she is helping to craft LANL's AM strategy document. Following on from her post-doctoral studies, she continues to study the aging characteristics of plutonium via a highly sensitive capacitance-based dilatometer.

Marchi, who has a PhD in biomedical engineering from Duke University, has volunteered as a science fair judge, presented to regional community leaders, supported the Lab's Summer Physics Camp for Young Women, and participates as an external review board member for New Mexico Institute of Mining and Technology's (NMT) Chemical Engineering Department. As adjunct faculty in its Materials Engineering Department, she mentors undergraduates and master's students.

Her previous Lab experience includes working in the gas transfer systems group (now Detonation Science and Technology, Q-6) as an NMT undergraduate student and additively manufacturing sensors, materials engineering structural health monitoring applications, and characterizing plutonium immersion density measurements as a Seaborg Institute Postdoctoral Fellow within the Engineering Institute as part of LANL's National Security Education Center.

Technical contact: Alexandria Marchi

Zapf and Zhu named American Physical Society Outstanding Referees

Vivien S. Zapf (National High Magnetic Field Laboratory-Pulsed Field Facility, MPA-MAGLAB) and Jian-Xin Zhu (Physics of Condensed Matter and Complex Systems, T-4) were recognized by the American Physical Society (APS) as 2019 outstanding referees for their volunteer work maintaining the rigorous peer-review process for the *Physical Review* journals.

Zapf, who has a PhD in physics from the University of California, San Diego is a physicist who uses the record high magnetic fields of the National High Magnetic Field Laboratory-Pulsed Field Facility to study magnetism and its interaction with ferroelectricity.



Zhu, who has a PhD in physics from the University of Hong Kong, is a member of the Center for Integrated Nanotechnologies quantum materials systems science thrust. He is a theorist who uses prediction techniques, including theory, modeling, and computation to study strongly correlated electronic materials, superconductivity, and quantum physics.



Each year APS editors select around 150 outstanding referees from roughly 71,000 current referees based on the quality, number, and timeliness of their reports, without regard for APS membership, country of origin, or field of research.

Technical contacts: Vivien Zapf and Jian-Xin Zhu

Davis and Greenhall recognized for 'Science in 3' presentations

Eric Davis (MPA-11) was recognized as an outstanding presenter and John Greenhall (MPA-11) received an honorable mention at the 2019 "Science in 3" competition. In the career development event organized by the Postdoc Program Office, Laboratory postdoctoral researchers presented their work to a general audience in under three minutes.

In "If explosives could talk," Davis described his team's portable prototype system that remotely identifies explosives instability when encountering an unknown explosive device

continued on next page



From left: Carol Burns (Science, Technology and Engineering, DDSTE); honorable mention awardees Kim Schultz (DARHT Physics and Pulsed Power, J-5), John Greenhall (MPA-11), and Deborah Shutt (Information Systems and Modeling, A-1); outstanding presentation awardees Derrick Kaseman (Bioenergy and Biome Sciences, B-11), Christina Hanson (Engineered Materials, MST-7), and Eric Davis (MPA-11); and Nan Sauer (Partnerships and Pipeline Office, PPO).

Recognizing achievement cont.

in the field. Davis, who has a PhD in physics from the University of Houston, is mentored by Cristian Pantea and Vamshi Chillara (both MPA-11). His research focuses on applied acoustics and using resonance and time-of-flight techniques to solve nuclear nonproliferation challenges.

In “Underwater directional detection/communication using collimated acoustic beams,” Greenhall described an acoustic source that improves the ability of submarine sonar systems to image underwater surroundings and communicate beyond current distances. Greenhall, who has a PhD in mechanical engineering from the University of Utah, is mentored by Pantea. His research focuses on novel ultrasound techniques for non-invasive measurement of material properties.

Also presenting from MPA-11 were Gabriel Andrade, Hung Doan, and Kannan Ramaiyan.

Technical contacts: Eric Davis and John Greenhall

Chintam recognized with distinguished student award

Kavitha Chintam (MPA-11) received a 2019 Los Alamos National Laboratory Distinguished Student Award. The awards are presented by the Student Programs Advisory Committee.



A post-baccalaureate student on MPA-11's Fuel Cell Performance and Durability team, Chintam contributed to the success of several energy-related projects. For her work on the Electrolysis Rocket Ignition System, she received a large-team Laboratory Distinguished Performance Award. In MPA-11 she researched catalyst loading, catalyst composition, and bipolar plate hydrophobicity and performed fuel cell electrode microscopy and neutron imaging of water. These contributions helped the team win a DOE 2018 US DRIVE Highlight. Chintam's work at Los Alamos has resulted in seven publications, on four of which she is first author; three patent applications as second author; and seven presentations. She is a PhD student at Northwestern University where, with support from a National Science Foundation fellowship, she will continue electrochemical research related to her Los Alamos work. Rod Borup (MPA-11), Chintam's primary co-mentor, nominated her—noting her technical achievements, her strong work ethic, eagerness to work on a team, and her drive to give back to her community.

Technical contact: Kavitha Chintam

Niendorf electrifies with ‘Lightning Talk’

Karl Niendorf (MPA-11) recently took to the stage at the J. R. Oppenheimer Center to present his work as part of Lightning Talks. In the TEDx-inspired event hosted by the Student Programs Office, students had five minutes to present their research to a broad audience.



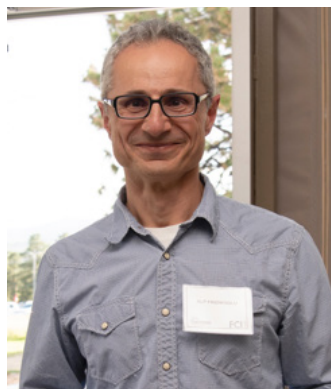
In “Directional sound propagation: Generation and applications,” Niendorf discussed the features of high- and low-frequency sound propagation for a variety of uses, including acoustic imaging, damage detection, and highly directional speakers. As part of MPA-11's Acoustics and Sensors team, he combined the penetration depth inherent in low-frequency sound propagation with the resolution provided by collimated, high-frequency acoustic sources. Niendorf used a laser Doppler vibrometer to measure and characterize acoustic waves in air by studying the effect that pressure has on light refraction.

Niendorf, a PhD student in mechanical engineering at the University of Utah, was mentored by Christian Pantea (MPA-11).

Technical contact: Karl Niendorf

Findikoglu inducted into Lab's Innovation Honor Society

Alp Findikoglu (MPA-11) has been inducted into the Los Alamos Innovation Honor Society, in recognition of his exceptional and long-standing contributions to scientific discovery, innovation, and technology transfer.



The Richard P. Feynman Center for Innovation (FCI) selects members of the honor society based on criteria that include a scientist's overall engagement in collaboration projects, protection and deployment of intellectual property, and other innovation indicators, such as intellectual property inventions, copyrights, and technology transfer efforts.

In nearly 25 years at the Laboratory, Findikoglu has worked on various applied science and technology development

continued on next page

Recognizing achievement cont.

projects. Examples include high-temperature superconductor frequency-agile filters, pulse shaping in nonlinear dielectrics, thin film materials development for flexible electronics and solar cells, demulsification and separations in mixed media using electric fields, capacitive deionization for desalination, and acoustic structural health monitoring. His recent work on Acoustic Large Area Monitoring (ALArM), in collaboration with industry, has led to several patents and copyrighted software, which are being licensed to Chevron USA, Inc. and Olympus Scientific Solutions Technologies, Inc. for commercial development.

Technical contact: Alp Findikoglu

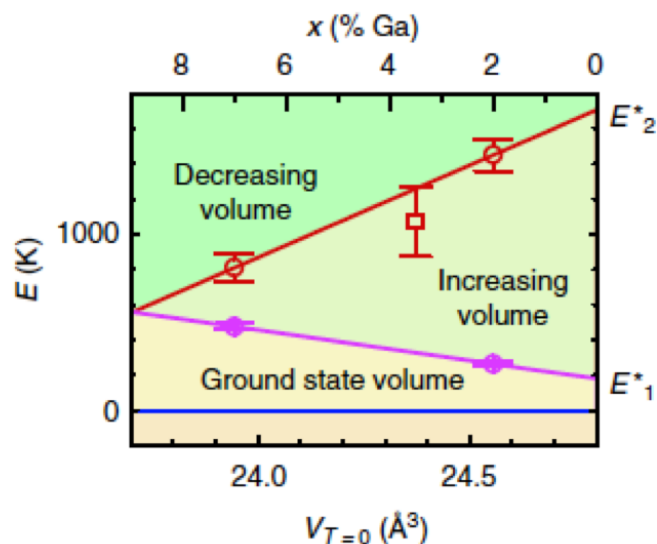


FCI recognized the Modular Integrated Non-destructive Test Setup (MINTS) team as a Richard P. Feynman Innovation Prize nominee. The MINTS team demonstrated a strong non-destructive solution for analyzing plastic deformation, cracking, and corrosion of nuclear material storage containers. The system has the potential to shift the nuclear material container surveillance paradigm towards larger population (non-destructive) testing in a shorter amount of time, at reduced cost and worker radiation exposure. The MINTS team includes Jonathan Gigax (MPA-CINT) and Matthew Davenport, Adrian Abeyta, and Rajendra Vaidya (Strategic Development Office, SPE-2).

Electrons are in charge of plutonium's extreme volume changes

Plutonium's tendency to undergo extreme volume changes has long been a thermodynamic mystery. However, a collaboration by Nuclear Materials Science (MST-16) and National High Magnetic Field Laboratory-Pulsed Field Facility (MPA-MAGLAB) researchers recently solved this enigmatic mechanism, demonstrating that plutonium's dramatic 25% collapse in volume between the delta and alpha phases is the result of two competing instabilities within plutonium's 5*f*-electron shell.

Their work represents a significant milestone for plutonium science at the Lab because it identifies the underlying



A plot depicting a particularly striking finding, which is that the two excitation energies (E^*_1 and E^*_2) of the *f*-electron shell instabilities change rapidly as a function of the gallium content x (upper axis) and in opposite directions. Circles indicate the gallium content at which magnetostriction measurements were made, while lines indicate extrapolation to other x values. The lower horizontal axis shows the approximate atomic volume $V_{T=0}$ of the ground state ($T=0$), thereby indicating that the excitation energies are primarily sensitive to the volume. Shaded regions illustrate the relative direction of the volume changes accompanying the excitations. The open square corresponds to the resonance energy observed in neutron scattering measurements.

mechanisms driving plutonium's equation of state and lays the essential ground work for understanding the thermodynamic aspects of aging. Specifically, their work shows that for a range of elevated temperatures, the largest contribution other than phonons to the heat capacity and entropy of delta-plutonium is electronic in origin. Moreover, this electronic contribution exhibits an extreme sensitivity to gallium content (used to stabilize the delta phase) and volume, thereby indicating the electronic entropy to be a major factor driving phase transitions in plutonium.

In research published in *Nature Communications*, the Los Alamos team used the high magnetic fields available at the Pulsed Field Facility to isolate the previously hidden yet substantial electronic contribution to plutonium's lattice thermodynamics. The magnetostriction technique, which they applied to plutonium for the first time, has an outsized effect in materials that have an *f*-electron-shell instability, such as rare earths and actinides, in which the *f*-electron shell within different atoms of the material may contain different numbers of electrons. The power of magnetostriction as a technique for isolating the electronic contribution to the lattice stems from the fact that there is no significant contribution to the magnetostriction other than that originating from the *f*-electron shells.

continued on next page

Electrons cont.

The magnetostriction of a material is the change in length or volume in response to an applied magnetic field. The technique works especially well in *f*-electron materials because atomic sites with different numbers of *f*-electrons are magnetic (to varying degrees) and would prefer to exist at different volumes, thus providing a means of fine-tuning the volume and the number of *f*-electrons in each shell with a magnetic field. It proves to be an especially powerful technique when combined with measurements of the thermal expansion, which also includes a significant contribution from changes in the number of *f*-electrons in each shell as a function of temperature.

In nearly all rare earth and actinide materials, a single *f*-electron shell instability (in which the number of *f*-electrons in each shell is subject to change) can be excited by high temperature and magnetic fields, and the effect will often drive a material's volume in a single direction—larger or smaller. However, plutonium was found to have two instabilities that drive volume in opposite directions at elevated temperatures. This not only makes plutonium highly susceptible to exist in a variety of different volume states (or crystalline phases) but also provides it with an extraordinary abundance of entropy at elevated temperatures. This entropy is maximized in the largest volume delta phase of plutonium at elevated temperatures, causing this phase to become the most energetically favored.

The sample preparation, sample mounting, and sample transportation logistics were performed by team members from MST-16. The magnetostriction of gallium-stabilized delta-plutonium samples was measured at the NHMFL using optical fibers. The fibers are adhered to the samples and have Bragg gratings etched into them so as to provide a means to optically monitor changes in length under varying conditions of magnetic field and temperature. The thermodynamic modeling was also performed at the Pulsed Field Facility, and its validity was confirmed by calorimetry measurements performed in MST-16. The calorimetry measurements further provide a robust thermodynamic connection between the strongly volume-dependent excitation energies of the *f*-electron shell instabilities and the previously reported excess entropy of delta-plutonium at elevated temperatures.

The work was performed under Los Alamos's Laboratory Directed Research and Development-Directed Research program: project 20180025DR. Measurements were performed at the National High Magnetic Field Laboratory-Pulsed Field Facility, which is supported by the National Science Foundation, the state of Florida, and DOE.

The work supports the Laboratory's Stockpile Stewardship and Energy Security mission areas and its Materials for the Future science pillar. It is significant in showing how the expertise from different Lab sites can be combined to solve long-standing problems in plutonium science and provide new diagnostic tools.

Researchers: N. Harrison J.B. Betts, M. R. Wartenbe, F.F. Balakirev (MPA-MAGLAB); S. Richmond (MST-16); M. Jaime (MPA-MAGLAB); and P.H. Tobash (MST-16).

Reference: "Phase stabilization by electronic entropy in plutonium," *Nature Communications* 10, 3159 (2019).

Technical contact: Neil Harrison

MPA-11 partnering with industry to improve biorefinery reliability

Acoustic sensors will provide real-time monitoring needed for 'smart' chute technology

Materials Synthesis and Integrated Devices (MPA-11) researchers are partnering with Jenike & Johanson to develop technology that increases the reliability of biorefineries. Biorefineries convert biomass to fuels and commodity chemicals normally produced from fossil fuels.

Leveraging MPA-11's expertise in materials characterization and technology development, Troy A. Semelsberger, Cristian Pantea, Hung Doan, Chris Hakoda, and John Greenhall (all MPA-11) will develop acoustic sensors for real-time monitoring of the systems that feed biomass into a biorefinery to increase operating time.

The partnership has been formalized through a new cooperative research and development agreement (CRADA) funded through DOE's Bioenergy Technology Office's (BETO) Feedstock Conversion Interface Consortium Directed Funded Opportunity (DFO). The DFO focuses on research and development to understand the root causes of feed handling failures and to develop technologies that increase the on-stream operational reliability of lignocellulosic biorefineries. Current biorefineries operate with an on-stream uptime of 30%.

Jenike & Johanson is a world leader in powder and bulk solids storage, handling, conveying, and processing with more than 55 years of industrial experience. The company will mitigate biorefinery "shutdowns" through the development of a novel "smart" chute for biomass solids handling.

The "smart" chute approach is an active control strategy that discards undesired biomass from entering the downstream processing train, and thus leading to fouling, plugging, equipment wear, and the like. Moisture is a pervasive property that affects the continuous and reliable transport of biomass feedstocks. The implementation of "smart" chute technology with active feedback control using accurate and robust in-line biomass moisture sensors is expected to be a game changer for the economic viability of integrated biorefineries.

continued on next page

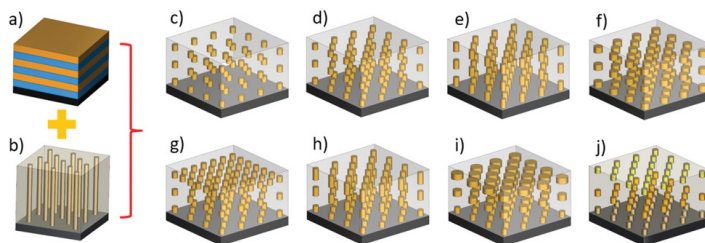
Simple ‘bottom-up’ method enables 3D super-nanocomposites

Controlling composition improves material's tunability

Embedding nanomaterials within a thin matrix creates a nanocomposite film with tunable physical features. By harnessing the material's emergent phenomena, nanocomposite films can be used for electronic and energy conversion devices. However, controlling the size, concentration, and distribution of nanoparticles during the film's synthesis has been a formidable challenge.

Center for Integrated Nanotechnologies (MPA-CINT) researchers with their external collaborators have overcome this obstacle in a simple, yet effective method of integrating multilayered materials and vertically aligned nanocomposite structures to create a novel 3D super-nanocomposite architecture with precise properties (see figure). Such a structure can be used to design advanced nanostructures with desired physical properties for a variety of material systems. Using this “bottom-up” design method, the feature size, distribution, and the spacing of nanocylinders can be

continued on next page



Structure design for advanced 3D super-nanocomposite (sNC) films. a) A superlattice, or multilayer, made by alternatively stacking two materials. b) A vertically aligned nanocomposite film with two phases vertically grown on a substrate. c) 3D super-nanocomposites enabled by a combination of superlattices and vertically aligned nanocomposites. The 3D sNC films can be tuned by d) the density of cylinders, e) the height of cylinders, and f) the lateral feature size of cylinders. The films can be further modified to achieve more advanced nanostructures by changing g) the nanocylinder density, h) the nanocylinder height, i) the nanocylinder feature size, and j) the chemical compositions in vertically aligned nanocomposite layers.

MPA-11 partnering cont.

Semelsberger, Pantea, Doan, Hakoda, and Greenhall will develop acoustic sensors for the *in operando* monitoring of biomass moisture content and plug-screw feeder wear and erosion. Such sensors are a critical need for the integrated biorefinery community. Existing biomass moisture content measurement techniques are based on surface measurements and do not provide information about the moisture content within the biomass flow. In contrast, acoustic waves penetrate through the biomass to enable non-invasive moisture measurement throughout the biomass flow.

MPA-11 will also develop acoustic sensors for the real-time monitoring of plug-screw feeder wear and erosion. Plug-screw feeders are designed to continuously feed plugs of biomass from low-pressure to high-pressure reactors safely and reliably. The significant safety hazards and unreliable operation of worn or eroded plug-screw feeders can be mitigated through the development of acoustic sensors that are able to detect small changes in the plug-screw geometry due to wear or erosion. The acoustic sensors developed for monitoring plug-screw feeders addresses the worst-case scenario of the “unplanned catastrophic shutdown” versus the “planned shutdown.”

Mark Elless is the BETO technology manager for this CRADA.

The work supports the Laboratory's Energy Security science mission area and its Materials for the Future and Science of Signatures science pillars.

Technical contact: Troy A. Semelsberger



FCIC-DFO kick-off meeting with Jenike & Johanson (J&J), LANL, and Bioenergy Technology Office (BETO) program managers. From left: Art Wiselogel (BETO), Andrew Kobusch (BETO), Babs Marrone (Bioenergy and Biome Sciences, B-11 Lab relationship manager), Cristian Pantea (MPA-11), Carrie Hartford (J&J), Troy A. Semelsberger (MPA-11), David Craig (Vice President and Director of Engineering J&J), Mark Elless (BETO technology manager). Not pictured: Hung Doan, Chris Hakoda, and John Greenhall (all MPA-11).

Simple 'bottom-up' method cont.

precisely controlled. By tuning these microstructure parameters, the researchers can control the lattice strain, which further enhances the material's electronic properties.

These nanostructured 3D super-nanocomposite materials were fabricated by using pulsed laser deposition systems in CINT, which are available to internal and external CINT users. CINT provides users from around the world with access to state-of-the-art expertise and instrumentation in a collaborative, multidisciplinary environment with a focus on nanoscience integration.

The work at Los Alamos National Laboratory was supported by the Laboratory Directed Research and Development program and was performed, in part, at CINT, an Office of Science User Facility operated for the DOE Office of Science jointly by Los Alamos and Sandia national laboratories.

The research supports the Laboratory's Energy Security mission area and the Materials for the Future science pillar.

Researchers: Aiping Chen (MPA-CINT); Zach Harrell (MPA-CINT, University of Texas at San Antonio); Ping Lu (Sandia National Laboratories); Erik Enriquez (MPA-CINT); Leigang Li, Bruce Zhang (both Purdue University); Paul Dowden (MPA-CINT); Chonglin Chen (University of Texas at San Antonio); Haiyan Wang (Purdue University); Judith MacManus-Driscoll (University of Cambridge); and Quanxi Jia (University at Buffalo, Konkuk University).

"Strain enhanced functionality in a bottom-up approach enabled 3D super-nanocomposites," *Adv. Funct. Mater.* 29, 1900442 (2019).

Technical contact: Aiping Chen

Celebrating service

Congratulations to the following MPA Division employees celebrating recent service anniversaries:

Mark Hinrichs, MPA-MAGLAB.....	35 years
Billy Vigil, MPA-MAGLAB	25 years
Alp Findikoglu, MPA-11	25 years
Jerzy Chlistunoff, MPA-11.....	20 years
Jennifer Hollingsworth, MPA-CINT	20 years
Mary Elizabeth Phipps, MPA-CINT.....	15 years
Rajinder Singh, MPA-11	10 years
Mun Chan, MPA-MAGLAB	5 years
Alexandria Marchi, MPA-11	5 years
Suchitra Ramani, MPA-CINT	5 years

HeadsUP!

Watch out for wildlife!

With the advent of winter weather it's important to be aware of the potential for increased wildlife activity on our roadways in the early mornings and evenings.

- **Slow down:** The most important way to avoid collisions with wildlife is to slow down and observe the speed limit.
- **Use your eyes:** Avoid a collision by keeping your eyes on the road.
- **Be mindful of peak areas and times:** Be on your highest alert at dusk and dawn, when many animals are most active.
- **Don't tailgate:** Keep a safe distance between you and the car in front of you to avoid any unnecessary accidents.
- **Use your brights:** Your high-beam lights are there for a reason, don't be afraid to use them.
- **Remember deer and elk travel in herds:** When you spot one deer or elk crossing the road, another is likely to be right behind.

MPA Materials Matter

Materials Physics and Applications

Published by the Physical Sciences Directorate.

To submit news items or for more information, contact Karen Kippen, ALDPS Communications, at 505-606-1822, or aldps-comm@lanl.gov.

For past issues, see www.lanl.gov/org/ddste/aldps/materials-physics-applications/materials-matter-archive.php



Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by Triad National Security, LLC, for the National Nuclear Security Administration for the U.S. Department of Energy under contract 89233218CNA000001.

